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THE IMPERIAL ENTOMOLOGICAL CONFERENCE.

The first Imperial Entomological Conference was held in London in June this year and an official Entomologist or Biologist from each of the self-governing Dominions, India, the Australian States and all the principal tropical Colonies and Protectorates was present.

Probably the importance and far reaching effects of such a conference are but imperfectly realized by the ordinary layman. This should not be so; the fact should be taken into consideration that in British Guiana, according to a recent conservative estimate, the actual financial loss to each individual due to insect activities, annually, amounts to some twenty-eight odd dollars—not to mention a quota of ill-health.

Further, it is now an established fact that the control of insect life spells success in the treatment of disease and in the production of food and other crops.

We regret that pressure does not enable us to present in this number even a short account of the many interesting meetings and important functions of this conference, a perusal of which should do much to eliminate any lack of realization which may exist in the mind of the public as to the benefits which accrue therefrom.

We hope, however, to give a full account in our next and succeeding numbers.

MEETING OF THE BOARD OF AGRICULTURE.

A meeting of the Board of Agriculture was held at the offices of the Board, Broad Street, on Thursday, July 22nd; His Excellency the Governor, Sir Wilfred Collett presided.

Arrival of Shorthorn Bull.

His Excellency appointed the Superintendent of the British Guiana Sugar Planters Experiment Stations a member of the Board. The death of Mr. John Junor was reported, an old and valued member of the Board. The arrival of the shorthorn bull was then considered. The total costs of importing this animal was $800.26, an abnormally high figure. The bull, however, was an excellent one and gave satisfaction; it was inspected by the members after the meeting.

District Agricultural Instructors.

The Chairman then informed the Board that of the three vacancies for District Agricultural Instructors only one had been filled. In one instance an applicant had been unable to obtain the permission of the manager of his school to carry out such work. The President remarked that in the next code an arrangement might be made to deal with such occasions.

Death of Guernsey Bull "Roland"

The Director of Science and Agriculture reported the completion and opening of the Agricultural Apprentices' quarters in Georgetown, compensation to the extent of $1,320 being paid to Plantation Uitvlugt as compensation for the destruction of eleven mules infected with Glanders and the death of the Guernsey bull "Roland". This animal was imported 13½ years ago at a cost of $236.18 and at the time of his death was 15 years old. He was the male parent of about 80 calves belonging to the

Government. During the period when his services had been utilized by the general public he had given 628 successful services. He became unfit for service purposes early in 1919. The completion and opening of the Government Vegetable Products Factory was also reported.

LIVE STOCK SALE.

The appointment of Mr. E. Beckett as the Board's Representative in Berbice was approved of and the old Sugar Cane Committee of the Board was dissolved owing to the coming into existence of the British Guiana Sugar Planters Experiment Stations Committee. It was stated by the Chairman that the animals on hand to be put up for the Annual Live Stock Sale were neither numerous or good in quality and the question of the actual necessity for such a sale consequently arose. After some discussion it was decided to hold the Sale in October.

WEST BANK AGRICULTURAL SOCIETY.

The Chairman then briefly outlined the chain of circumstances which had led up to an unfortunate position of affairs connected with the Board's Grant to this Society toward its annual show.

A number of Agricultural Societies and Associations were then approved for affiliation to the Board.

This being all the business the President adjourned the meeting *sine die.*

NOTES ON A COLLECTION OF PRESERVED DRY FRUITS AND SEEDS—(*Continued.*)

By J. F. Waby.

Melloa populi folio, of Brazil specimens, the fruit, and the seeds. Fruit oblong, flattish, 5-6 inches long 2-2¼ inches wide, 1¼ inches thick, hard-woody, dark brown dehiscing in 4 oblong valves ⅜ inch thick. The seeds many, flat brown, ⅝ inches long, ½ inch wide, with gauzy wings ¾ inch long and wide, lying flat on each other closely packed ; a stout woody replum in the centre, like the inner sole of a shoe showing the stitches all round. Foliage usually trifoliate, or twin leaves with a tendril between. Oval, 5½-6 inches long, 3-3½ inches wide, entire pointed, smooth, pale green, main veins few, prominent leaf-stalks 2¼ inches long, secondaries one inch. Inflorescence a large panicle terminal on all short branches. Flowers orange yellow, infundibuliform, tube 2 inches long ⅝ inch wide, expanded portion of 5 segments 2½ inches wide, the throat with raised markings of a darker tinge,—these on the underside are indented.—Calyx green, bladder-like, ¾ inch diameter, one inch long, pointed on front, the only division that through the tube passes. A very strong climber, a most wonderful sight when in full bloom. Specimens from Trinidad Royal Botanic Gardens.

Tanaecium Jaroba, of Guiana, the "Pear-Withe," "Rheinfarru". Specimens, the fruit and seeds. Fruit oblong 6-6½ inches long, 3-4 inches wide, gray speckled, dehiscing in two deep boat-like valves ⅜ inch thick, woody, yellow lined; the whole inside tightly packed with an innumerable mass of yellow wood-chip-like seeds, one inch wide and long, ⅛ inch thick, placed lengthwise from outside to centre like pallisade cells, a thin membrane-like replum passing down the middle, an outer thin brittle skin covering the whole mass. Foliage in opposite pairs, twin leaved or trifoliate, a tendril sometimes instead of the centre leaflet, ovate, 6 inches long, 3 inches wide, dark green above, silvery beneath ; leafstalks 2 inches long, secondary stalks short, midrib and

veins quite plain. Infloresence in bunches of 5 or 6 white flowers on short branches. Flowers tubular, 6 inches long, tube $\frac{3}{8}$ inch diameter increasing in size at top; corolla of 5 petals 3 inches across, irregular, faintly perfumed, falling early. Calyx green, $\frac{3}{4}$ inch long, circular like an ochrea. Pistil stout 7 inches long. After the flower falls the calyx and pistil remain attached for some time. Very few fruits are produced. A very strong growing climber mounting to the top of big trees. Specimens from Trinidad Royal Botanic Gardens.

Bombax Ceiba of South America, "Ceiba", "Comaka", "Silk Cotton", "Fromagier", "Cotton tree", "Mocmain", "Pullon".—Specimens the fruit, cotton and seeds. Fruit conical, green, 4 inches long, $1\frac{3}{4}$ inches diameter, pointed both ends, stalk $1\frac{1}{2}$ inches long; Calyx short, brown, persistent; dehiscing in 5 valves which shrivel on ripening; centre filled tightly with greyish white silk-cotton in 5 sections, enveloping the seeds which are like large black pepper-corns. After the valves fall off the cotton opens out and becomes fluffy, falls to the ground carrying the seeds with it, being distributed by the wind all over the adjacent land. Infloresence a compact terminal mass in closely set thyrses, usually produced when the tree is bare of foliage. Flower stalk one inch long; ovary conical one inch long, green; corolla whitish with rosy edges turned up, $1\frac{1}{4}$ inches wide, petals, 5 calyx of 5 sepals; stamens 5, stout, white with large yellow anfractuose anthers. Foliage compound, palmate, lanceolate, digitate; leaflets 7 in number, $3\frac{1}{2}$-$4\frac{1}{2}$ inches long, one inch wide, dark green above, paler beneath, midrib prominent, leaflets meeting at apex of leafstalk with very short stalks of their own. All parts of the leaf fall separately. A large deciduous forest tree with exceedingly strong main branches and very large buttresses. Specimens from Trinidad.

Sterculia Ivira, West Indies. Fruit in follicles, scarlet, $2\frac{1}{2}$ inches long, 1 inch thick, pointed, skin thick, not woody, dehiscing down the centre. Seeds 3-4, filling entire space, covered with a sweetish white pulp, looking like white sweetmeats. Infloresence in short terminal panicles

and axillary on naked branches; flowers small, rusty brown. Foliage dark green, oblong, 6 x 3 inches or a little less, entire, occasionally with one or two lobes towards the end. Midrib and veins distinct, petiole $1\frac{1}{2}$-2 inches long. A short shrubby tree with close branches. Specimens from Trinidad.

Guaiacum Sanctum, "Lignum Vitæ", "Lignum Guaiaci," of South America. Fruit cordate, emarginate, yellow, $\frac{7}{8}$ inch wide, $\frac{3}{4}$ inch long 5/16 inch thick, dehiscing in 2 irregular valves,—the one being half the size of the other,—generally 2 seeded, seeds black, elliptical $\frac{1}{2}$ x $\frac{1}{4}$ inch covered with a thick bright red closely adhering much like that of Arnatto. Infloresence borne all over the surface of the tree in short terminal racemes; flowers intensely blue, platter-shaped, about one inch in diameter, a most beautiful sight when in full bloom. Foliage in 2 pairs, each pair with 2 pairs of leaflets, oblong; outer pair 1-$1\frac{1}{4}$ inches by $\frac{1}{2}$-$\frac{5}{8}$ inch, lower pair half the size; several straight veins on the surface, smooth, dark green above, pale beneath. A large slow growing tree with grey bark which peels off constantly in patches. The branches brittle jointed at each divergence of leaf on branch. The bark material from which "Maubie" drink is made is said to be obtained from this tree. The wood is very hard and durable and is used in carpentry. Specimens from Demerara and Trinidad.

Terminalia Bellerica, one of the "Myrabolans" from India. The fruit pointed, conical, indehiscent drupe, $1\frac{3}{8}$ inches long, $1\frac{1}{4}$ inches diameter, brown, covered with a satin plush; the seed a hard stone $\frac{3}{4}$ by $\frac{1}{2}$ inch, pointed, with ridges from bottom to top, the space between seed and skin filled with a thick greenish mass. Infloresence racemose, terminal 6 inches long, and axillary just below the young foliage. Flowers close together, sessile, small, pale yellow, $\frac{1}{4}$ inch wide with exersted stamens, carrying quite a strong perfume of honey. Foliage oblong $5\frac{1}{2}$ inches long, $3\frac{1}{2}$ inches wide, stalk 2 inches, ordinary green above, glaucous beneath, in a crown of 6 or 7 together, veins few, prominent. A large umbrageous tree, well fitted for planting as specimens in Park Land. Specimens Demerara and Trinidad.—(*To be continued.*)

COFFEE.

A few Hints on Coffee Growing.

WIND BELTS AND SHADE TREES.

Strong winds are harmful to coffee. Not only do the old trees suffer from exposure to wind, but so also do very young plants; its effects are at once recognized in the pinched stunted and frost bitten look of the wood and leaves, also by the wind brand appearance of the base of the stem in the form of a bottle shaped swelling. Localities subject to strong winds should, therefore, be avoided, but even in other places it is often advisable to plant wind belts to protect the fields. Wind is likely to shake a young tree in such a manner that the trunk works a conical hole in the earth which proves fatal in strong soils by forming a receptacle for stagnant water causing the roots to rot. In older trees winds crisp the leaves twist the boughs, damage the blossoms before they knit, and disturb the growth of the fruit.

Windbreaks, therefore, should be planted where the situation is at all exposed.

Grevillea robusta has proved to be one of the best trees for this purpose, and also for planting in the field for shade; a thick belt of Wattle makes a good windbreak, provided it is at least thirty yards away from the coffee. *Eucalyptus saligna* also makes a good belt and is useful for timber; this again should not be planted near the coffee.

SHADING.

In high and exposed places shade trees should be of benefit particularly where hailstorms are prevalent, as they tend to prevent the hailstones damaging the coffee trees and crop. Also the following may be mentioned in favour of shade:—

(1) You get a more uniform crop.

(2) It lengthens the life of the plant.

(3) It is a safeguard against over bearing, and, therefore, will to some extent prevent die-back.

I am of the opinion that to interpose a moderate shade between the extremely hot sun and the coffee trees would help to keep the coffee in good condition and improve the quality of the bean; as, in every case where I have seen in this country more or less accidental shading, the appearance of the coffee has been better and more vigorous than in the unshaded areas. In one of these cases the shade tree alluded to was a large wild fig. But I would not advise this tree being used as a shade owing to its parasitic habits.

NURSERIES AND PLANTS.

Saplings are preferable and the best of all are plants which have been reared in nurseries on the plantation, so that the planter may be sure of the quality of the plants he is using. The purchasing of plants is inadvisable unless they can be procured from an absolutely reliable source. A piece of ground, on a gentle slope and where the mould is rich and crumbly, is the most suitable for a nursery: if possible it should be situated near a stream. In the Sotik, Kericho and upper Limuru Districts nurseries should not be made near the edge of the rivers or at the extreme foot of the valleys, as at certain times of the year the temperature drops too low and even frost has been known to occur in certain places. In these districts it is therefore advisable to make the nurseries on high open ground. The beds should be made about four feet wide and raised six inches; the distances between them being two feet six inches. This pathway between the beds also acts as a drain. The seed should be fresh and sound, the beans large and selected from healthy mature trees. Seed coffee must be pulped carefully so as not to injure the parchment skin, and if it cannot be planted at once, it should be partially cured in the shade and kept in a cool place.

Plant the seed in drills one inch deep, two and a half inches apart: the drills being five inches apart.

The seeds may also be planted thicker, and before the two first leaves unfold completely, the seedlings may be pricked out into deeper drills; this method gives a better root system.

There are roughly 2,000 coffee seeds to the pound.

The beds should be kept free of weeds and be shaded by screens about four feet high. Three or four months after germination the shade can be gradually removed. In some localities plants have been reared quite successfully without shade, but I recommend the former method.

The seed beds should be kept moist, but not water-logged. Twelve months old saplings with strong primary branches make good plants for transplanting into the shamba, although some planters prefer to stump these before planting. If the saplings are planted too closely or are allowed to remain too long in the nursery, they grow long and lanky, with poorly developed branches; before these are transplanted stump them to within six inches of the collar (or nursery mark). When these stumped plants shoot, a shoot midway on the stem should be encouraged; this will graft into the old stem better than one growing higher up, and will develop into a stronger tree. Fresh coffee seed takes about six weeks to germinate.

Cuttings grow readily, but this method is impracticable from a commercial standpoint.

LINING.

When the ground has been thoroughly prepared and is entirely free of weeds, the first work is to line out the rows and peg off the distances at which the coffee is to be planted. Two or more light chains of about 144 feet long, divided off every nine feet with little strips of red cloth, are used for this purpose, by means of which parallel lines can be marked out.

There are two methods of laying out the field, viz:—

(1) Square,

(2) Triangular,

of which I prefer the first. Planting in triangles has the advantage of saving ground, but has the disadvantage of narrowing the passage for the labourers and cultivators: and this method is more inclined to prevent free passage of air, which is so necessary to the trees.

ROADS.

On level or gently sloping land it is an easy matter to lay out a system of roads, so as to divide the coffee into blocks of about 90 yards square, thus having a road between approximately every 30 rows of plants. The main roads from the site of the factory should be about 27 feet wide, and the branch roads 18 feet. Apart from the advantage of an organised system of roads for purposes of supervision, especially during the gathering seasons, should the necessity arise of spraying the trees, this work will be much easier carried out if it is possible to supply the spraying machines with water by carts.

In hilly country it is more difficult, of course, to arrange a system of branch roads, but the plan should be followed as nearly as possible as the country allows.

HOLING.

In digging the holes, every peg must be as nearly as possible the central point. For small plants the holes should be about twelve inches in diameter and eighteen inches deep; for the larger type of plant, it is necessary to prepare larger holes, eighteen by twenty inches is recommended. Perhaps not so much is absolutely necessary for the success of the plant, but it is obvious that the tender roots will penetrate more easily into soil which has been well dug up. The subsoil taken from the holes must not be put back without mixing thoroughly with some surface soil.

PLANTING.

There are two planting seasons, approximately April-May, and October-November. The former, *i.e.*, during the long rains, is the better time for planting. It should

commence after the soil has been thoroughly moistened by the rains, and dull cloudy days are preferable for the work.

The choice of the plant is important, it pays in the long run to use only the best. Those which are "crowned," *i.e.*, which have four little primaries, are the type preferred; they would then be about twelve months old. The young plant should be taken up with the clod attached and planted without shaking it off. It is advisable to cut off an inch or two from the end of the taproot with a sharp knife; this prevents the possibility of its being twisted in planting. As the coffee plant is a tap-rooted shrub, and depends mainly on its taproot, it is of the utmost importance that this root should be straight and carefully put into the ground. The plants must be set firmly and not too deeply—not deeper than about $1\frac{1}{2}$ inches above the nursery mark on the stem.

It is safer to shade the young plants at first, to prevent them from wilting. The planting ought to be completed before the end of the rainy season, so that the young trees may have every chance during the succeeding dry weather. In the case of stumped plants, the plant should be set in the ground at an angle of 45 degrees, and all shoots appearing on the lower side of the stem rubbed off.

It is safest, before planting, to clip all the leaves of the young plant, cutting off about half of each leaf. This can be done in the nursery a week or so before transplanting. If this plan be carried out, it greatly helps the plant, and the shading can be of the lightest description.

MAINTENANCE OF THE PLANTATION.

It is necessary to keep the shamba free from weeds. Coffee requires the cleanest of soils: weeds keep it back and cause it to become anæmic and yellow. Plants in such condition are liable to harbour insects and be centres of infection of the fungoid diseases.

Frequent tilling or cultivating by keeping the surface soil open lessens evaporation, and this in districts (*e.g.*,

Kyambu and Nyeri) where there is the smallest rainfall of any coffee-growing country, is of considerable importance; it also ærates the soil, which æration is necessary not only to the coffee but to the micro-organisms which play such a great part in determining the fertility of the soil.

PRUNING.

The following terms are used in connection with the various pruning operations:—

1. Training
2. Stopping
3. Nipping
4. Pruning
5. Lopping
6. Capping
7. Suckers
8. Gormandising Limbs
9. Stem (trunk of tree)
10. Primary branches
11. Secondary branches
12. Tertiary branches

Primary branches are those which first appear from the stem of the plant.

Secondary branches are those which grow from primaries.

Tertiary branches are those which grow from secondaries.

1. *Training* is the first operation in pruning trees between the ages of 1 year and 3 years old, and consists in taking off all secondary branches which grow within a radius of 4 or 5 inches from the main stem. After this, alternate secondaries are left on each primary at about 4 inches apart, but all secondaries to within 9 or 10 inches from the end of the primaries must be taken off.

The second and third year tertiaries may be trained from the secondaries in the same manner as the secondaries are trained from the primaries.

2. *Stopping*, consists in cutting the top at various heights. It is advisable to stop at five feet 3 inches, but in very windy and exposed places four feet may be safer; this, however, would be seldom necessary in this country. Stopping is practised for various reasons:

(1.) By bringing the fruit within reach of the hand, it prevents the pickers bending and pulling down the boughs. Boughs which resist strongly are liable to break if bent, and a primary bough once broken never shoots again.

(2.) The tree acquires more strength and vigour, both above and below ground.

(3.) The form of the tree is more perfect.

(4.) None of the original lower branches are lost: these being nearer the "source of growth" are better nourished and more productive.

(5.) It affords less hold to diseases and pests. Under the same aspect and on ground of the same quality the trees should be stopped at the same height. They should be stopped at green wood as soon as they attain the proposed height. It is best to cut $1\frac{1}{2}$ inches above a knot, and the next pair of primaries must be cut off 1 inch from the stem. By doing this the sap is forced back into the next pair of primaries, and it is conducive to a well shaped crown.

Soon after this stopping process an abundance of sap is supplied to all quarters. If no nipping and pruning is done now, the trees will in time grow into a mass of tangled boughs inaccessible to the sun and deficient in the ordinary powers of fructification.

Some vertical green suckers with thick stems and large leaves shoot out from under the primary boughs; these are termed "gormandising" limbs, and should be removed. Vertical and cross branches, broken or damaged branches and those which diverge from the natural directions should be pruned off.

The top and centre of the tree must be well opened to admit the sun and air: if the tree is still too thick some secondary branches must be cut. Primary branches ought seldom to be cut unless they droop on the ground or have grown thin and slender: they can then be cut back to a secondary branch, or it may be necessary to cut the whole primary off. Sharp pruning knives should be used, and where the limbs are too large for a knife to cut, a sharp pruning saw should be used. In all cases it is necessary to cut close to the mother bough, but not so close as to shave off the bark.

The prunings should be cut in pieces and spread loosely on the ground—this adds humus to the soil. Better still, they could be collected and put into the manure pit.

3. *Nipping.*—The next process is nipping or as it is sometimes called "handling," or "feathering." This is done some ten weeks after pruning and consists in pulling off all young shoots growing in an upward or downward direction, and those growing towards the centre of the tree or crosswise. In most cases these shoots spring from every cut surface and sometimes a bunch of them will spring from one single cut. In all cases care must be taken to preserve such as have the most normal and horizontal direction.

All side suckers growing from the trunk of the tree should be removed unless in the case of an old tree where a new trunk is required, when one of these suckers may be allowed to grow.

In the "nipping" process it is best to use the knife as little as possible.

Pruning.—The more advanced stage of pruning usually starts in the fourth year after the trees have borne a heavy crop. It consists chiefly in cutting off old and weary wood; this encourages fresh growth and invigorates the tree. All dead wood s also taken off.

Pruning: Lopping.—When, from neglect, trees have become so weakened that their branches are merely long thin, whippy sticks, with hard sterile wood, it is advisable to so severely prune them as to merit the term of lopping. The primaries should be cut back to within 12 inches of the stem and the secondaries removed. This gives the tree a complete rest and a chance to make a more vigorous new growth; it is a matter of some difficulty to properly train the young limbs as the tree is apt to send out a great number of "Gormandisers" but in time it will develop into a good fruitful tree.

Some planters prefer another method of Lopping, which is to cut down the tree to within 12 inches of, the ground, and to then allow a new main stem to grow up: and in some cases this is preferable, although, generally speaking, the first gives better results, in spite of its being more troublesome to train.

Pruning—Capping Method—The Department has received many specimens of trees and limbs (chiefly primaries from young trees) suffering from Die-back. I am led to the belief that the reason of this dying-back is more or less accidental, and may be attributed to one or more of the following causes:—

(1) The tree having been improperly planted, *i.e.*, with twisted roots or in a badly prepared hole; in many cases where I have examined the entire tree, I have found a very defective root-system.

(2) A poorly nourished tree either from poverty of soil or from weakness caused by old cutworn damage.

(3) The tree over-cropping when too young, when the limbs are unable to bear the strain of producing a large crop.

The following method of pruning will help to check the tendency of the young trees to bear full crops before they are sufficiently mature. It has been successfully used in Costa Rica, where it is said to produce fine large

trees which bear heavy crops than the ordinary single stemmed tree. When it is intended to prune in this manner, the trees should be planted at 10 feet by 10 feet.

I am positive that this capping method would be the best to employ in this country, save in the colder higher districts, where growth is not as rapid as it is lower down.

In trees pruned in this method, the primaries have a tendency to grow out at right angles to the stem, or even in an upward direction; thus counteracting the fault so often found in this country of drooping primaries. It also doubles the thickness and strength of the primaries, secondaries, etc.

Where the double stem method of capping is employed all primaries below the 1st capping should be taken away, the idea being to build the tree up in stages and so strengthen the primaries. The first capping should be about 12 inches to 18 inches from the ground.

GATHERING CHERRIES.

Coffee should be gathered (picked) when ripe, *i.e.*, when a deep red colour. It is detrimental to the tree to allow ripe cherries to dry up and remain on the branches.

In very wet weather ripe coffee will drop of its own accord. If the cherries are allowed to remain on the tree till they assume a purplish-red or black colour, the pulping will not be satisfactory and no amount of skill in setting the pulper will enable it to do clean work. There is also the danger of getting "foxy" or reddish beans in the manufactured coffee which would increase the labour of hand-picking.

If cherries are picked unripe they will most probably get nicked or broken in the pulping. This depreciates the sample of coffee and adds to the work of preparing it for the foreign market.

STRIPPING.

The few inferior beans, ripe or green, which are left on the trees when picking is finished should all be stripped off before the next blossoming. This relieves the trees.

These strippings had best be treated as "native" or "Buni" coffee which usually finds a ready sale in the Somali trade.

Generally speaking, coffee is ready to be gathered at seven months from the time of blossoming. Two to three months after blossoming, an estimate can usually be formed of the amount of the probable crop.

YIELD.

It is on record that in this country coffee has borne, without the aid of manure, at the rate of one ton of clean coffee per acre, (the trees being planted at 8 feet by 8 feet), this would work out at over three lb. of clean coffee per tree. It is quite a common thing to see coffee bearing at the rate of two lb. per tree. With trees planted at 9 feet by 9 feet a fair average crop to expect would be 800 lbs. clean coffee to the acre, but to keep up this average, the trees must be given a fair chance, i.e., clean cultivation, pruning and manuring.

By the end of the third year one should reap between 3 and 4 cwt. of clean coffee per acre. The following year this should be doubled and between the 5th and 6th years the largest crop is generally produced.

PREPARATION OF BUNI.

Spread the strippings out thinly on the drying trays. Care must be taken to turn frequently as this class of coffee takes three times as long to dry as does ordinary parchment. It should be 'bone dry' before it is ready for the market.

PULPING.

Coffee should be pulped the same day on which it is gathered. If it is not possible to do this, spread the cher-

ries out on the floor of the cherry loft. If left in a heap, fermentation will set in and consequently the pulper will not do clean work and the parchment will be discoloured.

It is very important that the chops and brest of the pulper should be properly set and the copper be in good order. The burrs of copper should be set once a year.

FERMENTING AND WASHING.

As soon as the coffee has been pulped it should be heaped up and covered with sacks or matting and the water allowed to drain off.

No definite time can be fixed for the duration of fermentation as this depends on climatic conditions. Coffee is usually ready for washing after it has been fermenting for between 15 and 24 hours; in cold weather it will take longer.

A good test for sufficiently fermented coffee is to take three or four handfuls from the heap and hand-wash it in a bucket of water, when, if the saccharine matter leaves the parchment skin readily, the coffee is sufficiently fermented. If fermentation is not complete, the saccharine slime sticks to the parchment and the heap should be thoroughly turned and heaped up again and allowed to remain till properly fermented.

If allowed to over-ferment the bean has a pale yellowish colour which later turns to reddish-yellow. A bad bean, if cut open, will be found to have an unpleasant smell.

Over-fermentation is very easily detected by coffee brokers and often renders a crop difficult for sale.

After fermentation the coffee should be washed in several changes of water until thoroughly clean, washing rakes being used in this operation.

The skims and light coffee must be floated off into the draining or tail tank.

All light coffee must be kept separate from the good.

DRYING AND CURING.

If there is no plant for artificial drying, large barbecues or movable wooden platforms are necessary.

The parchment should be *thinly* spread over a large surface and turned frequently with a wooden rake to ensure even curing.

To obtain a sample of coffee evenly cured and uniform in colour is a most important matter to the planter.

Artificial curing has been tried in this country with success and I am inclined to recommend it, as the process of curing is quicker and the beans are more evenly cured than by sun heat.

Estimates of the cost of installing drying plants can be obtained from Messrs. John Gordon & Co., London; and from William McKinnon, Aberdeen, Scotland.

PARCHMENT.

As soon as the parchment has been taken from the washing and draining tanks it should be put on to the drying platform or trays. These should first be swept and any stray beans from a previous curing should be collected and not be allowed to mix with the fresh material.

Parchment should be dried with the least possible delay. To let it become wet or damp during the curing process is very detrimental. If dried coffee gets wet the bean assumes a whitish-grey colour and buyers demand a bluish-green.

When the parchment has been thoroughly dried it should be transferred to a well ventilated store where it may be kept with safety for several months. It should be turned every three or four weeks: this aerates the parchment and prevents it getting a musty smell.

No two or more lots of parchment should be mixed unless they be tested as to their equality of curing *i.e.*, coffee which has been exposed to the sun for say five days,

should not be mixed with that which has been exposed for six or seven days. If unevenly cured coffees are mixed, the result will be an uneven sample when in the clean. In full crop, half-cured coffee has often to be taken up from the drying platforms to make room for wet coffee. Such half-cured coffee must be kept in separate heaps in the store and turned frequently, and as soon as space permits, should be given a chance on the drying platforms.

Four to five days will make coffee safe to be kept in a store if turned frequently afterwards for a week or more.

When thoroughly cured and fit for "hauling" or for shipment in the parchment, the beans should be so hard that they cannot be marked with the finger nail. When bitten sharply they should break crisply.

If the bean when bitten, shows a whitish fracture, it is not sufficiently cured, and too much water still remains in it.

An experienced man can tell by the colour of the bean when curing has reached the proper stage.

—*Farmer's Journal, Vol. 2, No. 4.*

FIVE MINUTE CHATS WITH FARMERS.

By Rev. Eric R. O. Robertson.

I want to have a chat with you farmers on doing things for yourselves. If you want things done at all or done well you have got to realise very quickly that the sooner you get together and work for the accomplishment of what you have in mind the better it will be for yourselves, your children and the Colony in general.

You will remember that in my last conversation with you I pointed out that the best evidence that you were getting awake to your responsibilities and the dignity of your calling was your changed mental attitude to the problems confronting. The fact of the matter is that you failed to make headway during the past because you were thinking wrong. Let me put it this way; your own miserable poor-house thoughts about yourself and your calling reacted on your lives and no wonder that the harvest of your activities corresponded to the nature of your thoughts. It is a law of nature that like produces like and when years ago I began to think how best I could help you I decided that I would begin by helping you to see that you must assume a right mental attitude to your difficulties because it is the attitude of mind towards our problems that produces the force by which we succeed or fail in solving them.

As an example of our wrong thinking we looked to the Government to do everything for us.

If we wanted a pump for the parish or a koker for the village we never thought that by co-operation and thrift these could be acquired.

No; the Government was there with its Pandora box and you assumed an alms-house attitude and begged. But while the Government sufferd no injury by this action on your part, your own manhood was demoralized. You lost initiative and self-reliance and the spirit of independence and daring, priceless qualities that mean everything

to a man. The pity of it all is that our vote-catching politicians encouraged us to beg because it served a useful purpose to delude the poor dupes of electors. The newspaper Editors themselves were not free from blame. Not to encourage was to open the door to constructive thinking and it was better going along the beaten tracks than to blaze out a new trail.

You have got to depend on yourselves and not upon Government or the Representatives of the Combined Court if you want to improve yourselves. The moment the vast majority of farmers look to themselves for the help they require and realise they hold the key which will unlock the barred doors to independence and wealth, that day the problems facing us will be nearer solution.

Is there anything waiting to be done? Get together, make up your minds you can do it, and, strong in the confidence that you are bound to succeed, tackle the job.

The Corentyne farmers after 30 years' waiting and begging are going to get Irrigation and Drainage for themselves. They will get it. But if anything were needed to press home the lesson there is the history of two villages, Belair on the West Coast of Berbice and No. 28 the salt water lake village.

Both for the last 28 years have been wanting to improve matters There was no drainage or irrigation, the lands were uncultivated, the people poor and living a hand-to-mouth existence. Petitions galore were sent to the Government and everybody looked thereto for all they required. Nearly 9 months ago, with the help of the Rev. D. G. Munroe the people were spoken to and showed that while they looked to others no progress would be made. Mr. Munroe and I were able to impress the Belair people. They responded to our appeals to do for themselves. A loan of $4,000 has been secured, 200 acres of land empoldered and the village is on the way to better days.

No. 28 is still waiting on Government help and they will wait.

PROPAGATION OF SOME TROPICAL FRUITS.

CULTIVATION OF THE PAPAW.

The following article, has been contributed by Mr. R. S. Cunliffe, B.Sc., in continuation of other articles on the propagation of some tropical fruit :—

The papaya, generally supposed to be a native of the American tropics, is now a common form among the vegetation of most, if not all, tropical lands. Botanically the plant belongs to the tribe Papayaceae and the genus Carica, the latter of which includes several species all containing an acrid, milky juice, but differing in characters of foliage, fruit, etc, the only species of general commercial importance at present being *Carica Papaya* commonly known as the papaw. Even within the limits of these species, the characters of the plant vary considerably. The plant varies in height from 8 to 10 feet and from 4 to 6 inches in diameter of trunk to over 20 feet in height with a trunk diameter of 2 feet. The leaves and petioles differ materially in form and colour through several shades of green, with or without purple or violet-red markings. The fruits are mostly green when immature, but differ widely in colour when ripe, from green, yellowish-green. yellow, with or without red markings, to purple. The form of the fruit is equally variable, and may be oval or roundish, pear-shaped or oblong, and the size varies from a few ounces in weight to 25lb. The flesh is generally a shade of yellow, but in some strains it is reddish. A cross section of the fruit may show a thick meat with a small seed cavity, or a large interior cavity with a comparatively small amount of flesh. The seeds may be many, few or entirely absent. The flavour of the fruit of *Carica papaya* is also a variable factor, from insipid, through varying degrees of quality and intensity, to objectionably strong and camphoraceous. Perhaps it is in the sexual characters of this plant where the greatest interest, as well as

the greatest problems lie for the tropical horticulturist and plant breeder. On this basis alone no less than twelve or thirteen forms of the plant have been recognized, some at least of which are capable under certain conditions of changing over to other forms even of directly opposite sex. This habit is well exemplified in the male trees, which if topped or otherwise injured, may sometimes be induced to assume the aspect and bear the flowers and fruits of the female. As is known to most people in the West Indies who possess even a casual acquaintance with this plant, it is approximately true to say that male and female flowers are borne on different plants, and that the pollen of the male flowers must be carried to the flowers borne by the female tree by insects or other means before such plants bear fruit. Those who have had some experience in growing papaws will agree that it is not often that one has to worry about the possible deficiency of male blossoms in his fields. Unfortunately there is frequently much more reason to be concerned over the superabundance of male trees, some plantings, even from carefully selected seed, resulting in nearly all male trees. Although, however, it may be approximately true to divide papaws into these two main classes, it is not, fortunately for the plant breeder, an invariable rule. In fact there are few races of plants that show the peculiar sex variation and gradations found in this species.

Some of the more important of these variations are as follows :—

(1) The female papaw is one of the commonest and best known of these types. The distinguishing characteristic of this is that the tree bears only female or pistillate flowers, which, in order to develop fruit, must receive pollen from the flowers of the male tree. The fruits vary in form and other characteristics, but are usually roundish or oval.

(2) The opposite of the above is of course the male or staminate tree, easily known by its long branching panicles of flowers, which, in the typical male tree, are

invariably staminate or pollen-producing. Therefore such plants bear no fruit, and are only of use to produce pollen necessary to fertilize the pistillate flowers on other trees. There are however, several forms of pollen-bearing trees, one of which differs from the ordinary and typical male tree in that some of the flowers are hermaphrodite, that is they possess both male and female organs. In such cases the so-called male tree bears fruit developed from the hermaphrodite flowers. The fruits are usually small, and vary in shape, being oval, oblong, or pear-shaped, and may be few or many, according to the number of fertile flowers. Frequently such fruit do not reach maturity, as they become too heavy to be supported by the long slender peduncles, and so fall to the ground. The phenomenon is interesting, as showing the possible variations within the species, but is valueless from a commercial point of view. Frequently the ordinary male tree can be made to produce fertile fruit-bearing flowers by wounding the plant.

(3) Besides the forms above noted we have a form of tree which resembles the ordinary female plant in general appearance, but differs from it in bearing two types of flowers, both borne on short peduncles close to the main stem like the ordinary pistillate blossoms. One form of these consists of male flowers, bearing only pollen, which, however, so far as is known, appear to be sterile. The other form is a hermephrodite flower resembling the ordinary female bloom in outward form, but somewhat more elongated, and self-fertile, and therefore independent of pollen from the male tree for food production. This type of tree is probably the most important, and is the most desireable to propagate from the point of view of the practical horticulturist, as the unproductive male tree is thus eliminated, or at least reduced to a very small number, thereby increasing the production and consequently earning power of a given area of land planted to this crop. Other forms of this tree are known to exist, differing from one another and from those above mentioned chiefly in character of flowers and fruit, but as such are only

variations in degree from a common type, they are not mentioned here.

Owing to the peculiar variations of this plant, especially as regards its flowering and fruiting characters its successful propagation presents some interesting problems. As long as the trees are grown only as isolated specimens for home use, the fruiting characters of the plant are perhaps not a matter of great importance, though even here the failure of the product of a few trees to reach the standard of excellence desired by their owner is apt to result in more or less vexatious disappointment ; but when an attempt is made to raise the crop on a commercial scale the failure of a certain number of trees to produce the quantity or quality desired presents quite a serious financial aspect. Therefore it is necessary, at least when growing the crop for market, that some other method of propagation be adopted than that of haphazard sowing of the seed. Papaws are grown in tropical countries for two main objects : for the fruit, and for the production of papain. When the crop is grown for the first of these objects there are perhaps three principle ends to be desired in its successful cultivation. First, the reduction of the percentage of unproductive (male) trees to a minimum, or the elimination of them entirely. Secondly, the increase of the productive capacity of bearing trees. Thirdly, the improvement of the quality of the fruit along such lines as size, thickness of flesh, flavour and aroma, keeping and carrying quality, and general adaptability for market requirements. With the object of best attaining such ends several methods of propagating this crop have been tried at different times and in different places. Several of these have been successful in the main, or are promising, while others have failed. The oldest and commonest methods of propagating papaws is from seed, and when carefully carried out, seems to offer the greatest promise of success, but if due care is lacking, the result is apt to be disappointing.

It has been proved that, by repeated selection of seed from plants bearing a large proportion of hermaphrodite

flowers, the percentage of unproductive trees can be reduced to a minimum, but the selection must be rigidly kept up, as there is always the tendency for the type to break up, especially if the plants are subjected to sudden changes of environment, such as removal of seed from one locality to another.

Another method of reproducing trees of valuable types which has been resorted to is that of grafting. Several methods have been tried. The best results are obtained by using as stocks seedling plants in a very early stage of their development, when the stem is not larger than an ordinary lead pencil, and preferably less. Suitable material for scions is usually more difficult to get, but if, shortly before it is intended to carry out the operation, the selected trees which it is desired to propagate, are cut down so as to leave a stem of 4 or 5 feet in height and fertilized with ½ to 1 lb. of nitrate of soda per tree, and well watered, they will produce a considerable number, sometimes as many as fifty, of young shoots. As soon as these reach the required size, and before they acquire a greater diameter than that of the stocks it is intended to graft them on, they are removed by means of a sharp knife, at the same time cutting off one-half to two-thirds of the leaves to prevent too rapid evaporation of moisture. The stocks on which it is intended to graft these should some time previously have been established in pots or cans, and be in a rapidly growing condition. These are cut off with a sharp budding knife several inches above the surface of the soil, and the stem carefully split downwards to the length of 1½ to 2½ inches, according to the size of the stocks and grafts used. One of the shoots previously removed from the parent tree is now cut wedge-shaped at its lower extremity, and fitted neatly into the incision in the stock.

A pin is then run through the stock and scion at the point of union, at right angles to the incision, to prevent slipping of the cut surfaces, and the union bound with soft string or raffia fibre, to hold the parts in place. The grafted plant ought to be set in the shade till the joints

are well callussed, and growth of the scion started. When this has attained the height of about 18 inches, it is ready to transplant to its permanent position. Unfortunately this method of propagation, so successful with other fruit trees has been found to be disappointing in the case of the papaw. It has been found after carrying the process through several generations that the vitality of the tree degenerates, resulting in the production of small and inferior fruits, unless the scions are continuously taken from seedling trees, in which case the process of grafting ceases to have any advantage over production by means of seed. Papaws may also be propagated from cuttings by removing the small side branches frequently found on the trunks of older trees, or by practising the method above indicated in connexion with grafting, but the cuttings must be fairly matured before removing. This process, however, has no practical value on a commercial scale, and is probably open to the same objections as noted above with grafting.

Papaws, when once well established, are of comparatively easy cultivation. They will grow and bear fruit on a variety of soils, but for the best results the land should be a fertile loam with plenty of organic matter. The roots are somewhat tender, and do not thrive well in hard soil. The seed, which should always be carefully selected, may be sown in a seed bed of fertile soil, and as soon as the young plants attain the height of about 2 inches they should be pricked off into pots, and kept in a rapidly growing condition till ready to be set out in the field. Plants removed directly from the seed bed to the field are apt to receive a severe check in growth, and the percentage of losses will probably be high. The papaw will respond well to good cultivation and manuring with either stable manure or chemicals, preferably both. To produce the best results the plantation should be made in a location well sheltered trom the wind. The plants are tender, and easily broken by strong winds, while continued exposure to the drying action of a steady breeze results in reduced leaf surface, and an unthriftv condition, with small and inferior fruits. The trees will bear fruit in about a year

from seed, sometimes less, the actual time depending on the conditions under which they are growing. While papaws will live and produce for three or more years under favourable conditions, as a rule the productive power of the trees decreases in quantity and quality. The increased height of the plants renders it difficult to pick the fruit, and the risk of damage from wind is so augmented, that it is advisable to replace older trees with young ones as soon as deterioration becomes evident.

Pruning of the papaw has been experimented with from time to time in the hope that the operation would result in increased productiveness, or change the sex of the male trees, or otherwise prove beneficial. The usual method pursued is to cut the top off the tree just before it reaches the flowering stage. This causes the production of several young shoots or branches, of which all but three or four of the strongest and most vigorous are removed, and the tree allowed to develop a rounded head. After such an operation it has been found that the number of fruits is increased, but their average size is greatly reduced. Topping of trees in this manner is also sometimes resorted to as a means of regenerating old trees under special circumstances. Thinning of the fruits has also been experimented with at various times, and by different investigators. The general results of the trials indicate that removal of some of the fruits undoubtedly results in increased size of those remaining, but the increase in price obtainable for the smaller number of relatively larger fruits on trees so pruned, has not, as a rule, been sufficient to justify the practice. There are, however, indications that a moderate amount of thinning of the fruit where they are over-crowded to such an extent as seriously to interfere with their proper development, is profitable.

—*Agricultural News, Vol. XIX, No. 477.*

SOIL DISINFECTION BY HOT WATER.

The use of steam for soil sterilisation has now become a routine practise among growers of Tomatoes under glass, and the beneficial results which are achieved by this method of soil treatment are so well-known as not to require further emphasis; but for cultivation in small greenhouses and for seed raising in pots and boxes, steam sterilisation, owing to the fact that it entails a special plant, has never been generally adopted ; for such work some simpler method is required. Of these methods the chief are the hot water process, the formaldehyde process and that involving the use of carbon bisulphide. There is little doubt but that if the gardener were persuaded of the beneficial results to be obtained by soil sterilisation for greenhouse work he would adopt it as part of his routine practise, and, therefore, it is desirable that his attention should be drawn to the results secured by MESSRS. BYARS and GILBERT in their recent experiments * in soil sterilisation by hot water.

For the purpose of their experiments these authors used, in the first place, soil known to be infected with various soil pests such as the root-knot nematodes, or eel-worm, *Heterodera radieisela*, which does serious damag to Tomatoes, and various soil fungi, inlcuding the "damping off" fungus (*Pythium debaryanum*) and species of Rhizoctonia, which cause lesions in the stems and root discoloration.

A preliminary series of experiments gave most encouraging results, which were confirmed by further investigations. In both sets the numbers of seedlings which grew and the vigour of the plants which they produced were markedly greater in the pots which had been treated with hot water than in those which had not been treated and were used as "controls."

Not less convincing was the appearance of the roots and stems of the treated as compared with those of the

* U.S. DEPT. OF AGRIC., BULL. NO. 818, Washington D.C., January 5th, 1920.

untreated plants; for whereas the former were clean and healthy, the latter showed all manner of unhealthy symptoms indicative of attacks of soil pests.

In the pot experiments 4-inch and 8-inch pots filled with soil were treated in one of two ways; either the pots were immersed in boiling water for a definite period of time—2½, 5 or 10 minutes—or a measured quantity of boiling water was added to the soil in the pots; the amount in the case of the 8-inch pots was either 1 litre (1¾ pints,) 2 litres or 3 litres per pot.

In addition to the pot experiments others were made with soil on greenhouse benches. In these experiments the soil, which was 5 inches deep, on a bench 3 feet by 4 feet, was divided by 1 inch boards into 4 sections and boiling water was poured in each of 3 of the sections at the rates of 2½ gallons, 5 gallons and 7½ gallons per section: the highest application amounting to 7 gallons per cubic foot of soil.

After this treatment the soil was allowed to drain and dry for four days and was then sown with Tomato or Lettuce seeds.

In all cases the treated soil gave results superior in every respect to those given by the untreated soil or that watered with cold water only. The plants in the partly sterilised soil were numerous and vigorous; the average number of seedlings in the part sertilised soil and in the 4-inch pots was 42 as compared with an average of 12 in the untreated soil. Damping-off occurred in the last, but did not take place in the pots, the soil of which had been subjected to boiling water. In the 8-inch pots the average number of seedlings two weeks after planting was, in part-sterilised soil, 74; in the untreated, 22. The height of the plants in the 8-inch pots which had received the larger treatment was 4-5 inches, 3-4 inches in those which had received a lesser quantity of boiling water and only 2 inches in the untreated pots.

The remarkable differences between the seedlings is shown in a striking series of photographs which bring

home in a most convincing manner the extents of the risks to which plants in their seedling stage are exposed, and the heavy toll taken of them by soil pests. The practical conclusions reached in these experiments are:—

(1) That soil in 4-inch pots may be rendered free of soil pests by submersion in nearly boiling water (208° F.) for 5 minutes.

(2) That 3 litres (5¼ pints) of boiling water poured on the soil in 8-inch pots suffice to destroy the soil pest.

(3) That bench soil is freed from them by the addition of boiling water at the rate of 7 gallons per cubic foot, and in end boxes 14 x 30 x 3 inches the soil requires 4½ gallons. It is important that the water used for sterilising should be kept on the boil during its use.

Lest it should be thought that the treatment is only worth while when soil known to be heavily infected has to be used, it is worth while drawing attention to another set of experiments made by the authors in which they hoped, by using fresh soil side by side with soil known to be infected, to show how much of the beneficial effects of partial sterilisation was due to the destruction of the soil pests and how much to the action of heat in liberating plant food from the soil. The experiment failed owing to the fact that the fresh soil was found also to be infected with soil pests. Indeed, it may be stated with confidence that most, if not all, soil likely to be used in this country for greenhouse work is to a greater or lesser extent infested with pests harmful to plants and that therefore it is a wise precaution to treat it with hot water.

Since it is well known that the rate of growth of a seedling foreshadows the rate of growth of the mature plant it is much to be desired that experimenters would ascertain by following the subsequent growth of seedlings raised in partly sterilised and unsterilised soil, whether it is not true that the former make larger, more vigorous, earlier maturing and more prolific plants than those reared in unsterilised soil.—GARDENERS' CHRONICLE, Vol. LXVII, No. 1,729.

SOUR SOIL.

Sour soil conditions arise from several causes: The alkalinity may have been reduced by cropping land without liming; the decaying process of the green roughage manure, and other organic matter turned in, and the excretions of the plant roots, may all have helped to set up the acid condition. The acid condition has sometimes been charged to the continual use of chemical fertilizers, but the scientific men have exploded this theory. Dr. Wheeler, formerly Director of the Rhode Island Experiment Station, says:—It is well established that if a soil to which superphosphate has been added remains quite moist for a considerable length of time, the sulphate of lime which is associated with the superphosphate may be partly changed to carbonate of lime within the soil by processes of reduction. When this occurs, the carbonate of lime which is formed will naturally tend to lessen the acidity of the soil."

Recently, Professor S. D. Conner and his fellow workers at the Indiana Agricultural Experiment Station have shown that acid soils and silicates, after receiving acid phosphate, were less acid than when they were untreated.

They believe this is due principally to the re-action of the phosphoric acid upon salts of aluminum.

Director Brooks, of the Massachusetts Agricultural Experiment Station, has conducted field experiments with superphosphate covering a period of many years. He states that "no injurious secondary effects are known to be associated with any reasonable use of dissolved phosphates."

The question has been studied likewise by Professor G. H. Hite, of West Virginia University. He has tested hundreds of samples of soil from various parts of West Virginia, and reports that three-fourths of the sour soils and practically all the sourest soils in that State have never had fertilizer.

It appears, therefore, that fertilizers, which some people have been condemning because they were supposed to increase soil acidity, really lessen it, and thereby actually improve their chemical re-action.

Farmers' Union Advocate, New Zealand.

A NEW SOURCE OF PLANT-FOOD.

The use of leguminous crops for soil improvement has long been recognised by good farmers as desirable. Aside from the general benefits of crop rotation, the actual soil-enrichment is due largely to an accumulation of available nitrogen, and this gain in nitrogen is caused by the presence of minute soil-bacteria which possess the power of growing on the roots of the legumes and then utilizing or 'fixing' the free nitrogen of the air and converting into food for succeeding crops."

North American farmers have become quite familiar with these nitrogen-gathering leguminous plants, and they play an important part in the cultivation of numerous crops. Cow-peas, velvet beans, vetches, and other legumes are sown between rows of fruit trees and plowed under when they begin to bloom, in order that the nitrogen which they have gathered in the small nodules upon their roots may be utilized by the trees. The use of these green cover-crops lessens the amount of other fertilizer which it is necessary to apply to the orchard.

Attention has recently been called to certain plants which gather nitrogen, like the legumes, but which store it in small nodules on the leaves instead of on the roots. One of these is *Psychotria bacteriophila*; it has been shown by ZIMMERMANN and FABER that *Pavetta Zimmermanniana* and probably other rubiaceous plants have the same habit. These plants, which belong to the same family as coffee, are, like the latter, tropical in their distribution.

FABER has shown that these leaf-nodules contain colonies of a non-motile nitrogen-fixing bacterium which he has named *Myco-bacterium rubiacearum.* These bacteria almost invariably inhabit the micropyle of the

young seed, and, when the latter germinates, grow through certain stomata of the young leaves and into the intra-cellular spaces formed in the leaf-tissues around these stomata. Cavities are formed through the growth of the epidermal cells which later close entirely and make bacterial nodules which are deeply imbedded in the leaf tissues. A single leaf may have several dozens of these symbiotic bacterial nodules. FABER was able, by treating the seeds with hot water and a sublimate solution, to kill the inhabiting myco-bacteria, and, later, to infect part of the seedlings grown from these seeds with pure cultures of the bacterium. The artificially-infected seedlings grown in soil free from combined nitrogen grew well and remained healthy for four months, whereas those not so infected turned yellowish-white and died in three or four weeks. The plants from unsterilized seeds produced leaves bearing many more bacterial nodules than did those from sterilized seeds which were later artificially inoculated.

In view of the fact that these rubiaceous plants with nodule-bearing leaves occur in many parts of the tropics, and that in India the value of their leaves has long been recognised, and considering the importance of nitrogen-fixing legumes as soil enrichers, the suggestion of FABER that we may have in these trees and shrubs plants of positive agricultural value deserves the serious consideration of tropical planters. If they can be grown as subsidiary crops beneath plantations of rubber, cacao, coffee, or other important tropical cultures, and their leaves allowed to accumulate upon the ground to serve a mulch and as nitrogenous fertilizer, they may have great value. They differ from the leguminous cover-crops, in that they are perennial in habit, and will not need to be replanted every year. It might be possible to prune them severely every year and utilize the clippings as fertilizer. The subject is one which opens up a new field in connection with tropical agriculture, and one which offers remarkable possibilities.

—*Journal of Heredity, Vol. X. No. 7.*

TO PREVENT THE RAPID DECAY OF RIPE FRUIT.

Certain experiments have recently been conducted in the Jodrel Laboratory, Kew, with the object of ascertaining the relative value of various substances in preventing the rapid decay of ripe fruit. These experiments were based on the fact that the primary cause of decay and rotting of ripe fruit is in most cases due to the presence of the germs of fungi, yeasts, bacteria, etc. on the surface of the fruit and not—within a definite limitation of time—to any inherent tendency on the part of the fruit to decay. Among the various substances experimented with commercial formalin—(formaldehyde, 40 per cent.) proved to be most suitable on account of its efficiency, cheapness and ease of application and because of the entire absence of danger in its use. The method of the treatment is here reproduced.

"In the case of fruits, where every part is eaten, as strawberries, etc., the fruit should be immersed for ten minutes in cold water containing 3 per cent. of commercial formalin. On removal immerse the fruit for five minutes, in cold water, and afterwards place it on wire netting or some similar open material to drain and dry. When the fruit has a rind or skin which is not eaten the immersion in water after the treatment in formalin can be omitted with advantage."

During the season a good series of experiments have been conducted at Kew, for the purpose of checking the results previously obtained, and of experimenting with other kinds of fruit. No special selection was exercised in procuring the fruit for experiments. The plums, cherries, grapes and pears, were purchased at a local fruit shop, and the gooseberries and bananas were obtained from a street vendor. In each case a certain portion of the fruit was treated with formalin; this was placed alongside an untreated portion on a plate of glass, the two were covered with a bell jar, and exposed to the ordinary temperature of the laboratory. The following table shows the number of days that treated fruit remained perfectly sound, free from mildew, after

the untreated check fruit had become covered with mould, and quite unfit for use:—

Plums	Damson	9 days
	Victoria	5 „
Bananas	... ...	10 „
Currants	Black	5 „
	Red	4 „

The following table shows the kind of fruit used last year for testing the preservative properties of formalin, and indicates the number of days during which treated fruit remained perfectly sound, after the check or untreated fruit had become unfit for use. The first column of figures indicates last year's experiment, the second column to this year's corroborative experiments.

Cherries	7 days	8 days
Gooseberries ...	7 „	6 „
Grapes	4 „	6 „
Pears	10 „	9 „
Strawberries ...	4 „	5 „

It is important to remember that all kinds of fruit experimented upon were quite ripe and been exposed for sale, and were consequently exposed to infection, and that in some instances they were more or less bruised. With fruit carefully gathered and treated at once, the duration in a saleable condition might be anticipated to extend over a longer period of days than is indicated by these tables. In the case of apples that are just pitted with disease, treatment with formalin proves of service. Apple rot caused by fungus called Glocosporium fructigenum, Berk, is very destructive to ripe fruit, on which it first appears as minute scattered spots on the skin; these spots rapidly extend and form large, brown sunken patches; within a short time this fungus reduces the fruit to a brown rotten mass. A dozen apples showing the first stage of this disease were immersed for a quarter of an hour in a solution of formalin of the strength given above, and afterwards dried. This was done

during the last week in August, the spread of the diseased parts was completely arrested, and the apples were at the end of November in good condition. A dozen similarly affected apples collected at the same time but not treated with formalin, were completely rotten by the end of September. By employing the method of treatment described, pitted or slightly diseased apples can be kept in a condition fit for use for several weeks longer than when no treatment is applied. This is a point of importance both to grower and fruit dealer. In the case of householders, and others who store a quantity of apples for winter use, it would well repay the very small trouble incurred to treat apples previous to storing. The method is simple, put ten gallons of water (preferably rain water) into a cask or zinc bath ; add three pints of formalin, mix thoroughly ; then immerse as many (preferably rain water) into a cask of zinc bath; add three points of formalin, mix thoroughly; then immerse as many apples contained in a net or loosely-woven sack, as the water will cover. The fruit after remaining in the solution for ten minutes, the sack being partly lifted up to ensure every par of its contents coming in contact with the liquid should be removed from the sack and placed on a layer of straw, hay, or some suitable substance to drain and dry. It is not necessary to immerse in water, after their removal from the formalin mixture apples that are intended for storing. Plums, strawberries and other soft fruits should be placed in a sieve or some such firm open structure for immersion in the solution. The strength of the formalin solution does not deteriorate by use, so that the process of sterilizing batch after batch of fruit, can be continued until the solution is practically used up in the process.

FOR TROPICAL FRUITS.

However valuable the method of fruit preservation described here may be in extending the duration of ripe fruit in good condition for local use, the greatest benefit, will be in connexion with export fruit. Many kinds of tropical fruits,

which owing to their rapid deterioration and decay are never sent on long journeys, could be exported if treated in this manner before shipment. The fact that many tropical fruits decay very quickly in their native country is, in reality, no argument against the suggestion. It only indicates that in the warmer countries, as in every other land, the surface of every ripe fruit is loaded with spores of fungi, wild yeasts, etc., which attack the tissues and set up a fermentation that is often mistaken for the normal decay due to over ripeness. As an example the state of semi-decay in which bunches of bananas frequently reach England is, in most instances, entirely due to the attacks of various superficial organisms capable of inducing fermentation. This could be prevented by the adoption of the port of shipment of the treatment recommended above.

—*Farmers' Journal, Vol*. 2, *No*. 13.

CASSAVA AS A SOURCE OF INDUSTRIAL STARCH AND ALCOHOL.

Among the economic plants of the Empire whose cultivation could be profitably extended, a prominent position should be assigned to cassava or manioc. Two forms of this plant are cultivated, "sweet" cassava (*Manihot palmata*) and "bitter" cassava (*M. utilissima.*) The tuberous roots of both forms are rich in starch, and are used as a foodstuff in the countries where the plant is grown, for the preparation of tapioca and other food products, and as a source of starch for industrial purposes. An article dealing with the cultivation and utilisation of cassava was published in this BULLETIN (1915, 13, 581), and from the number and nature of the enquiries received at the Imperial Institute since then, it is clear that there is room for a considerably increased output of cassava products, for use as food and also for several purposes for which other farinaceous materials are at present employed in this country. In the present article the question of the industrial utilisation of cassava is dealt with more fully than was possible in the previous article, particularly as regards the use of the starch in the textile industries and the manufacture of industrial alcohol from the roots.

TRADE IN CASSAVA PRODUCTS AND OTHER FARINACEOUS MATERIALS IN THE UNITED KINGDOM.

There is a large demand in the United Kingdom for cassava products, which is at present met chiefly by imports from foreign countries.

Before the war the chief countries supplying farina and rice flour were the Netherlands, Germany and Belgium, but in 1917 and 1918 almost the entire supplies came from Japan. The United States supplies most of the "starch other than rice starch" (consisting largely of maize starch), all the glucose and a large percentage of the dextrin, although in 1918 nearly half the dextrine came from Japan.

Cassava starch has been tried as a sizing material for textiles in this country, but up to the present it has not been accepted by either the wool or the cotton trade as a satisfactory substitute for the farina, sago flour, wheaten flour or maize starch to which they are accustomed. In this connection colour is an important factor; it has recently been reported to the Imperial Institute that successive shipments have been found to vary considerably in colour, and under the circumstances consumers will not believe that they are receiving a product of uniform quality, whatever may be the evidence of chemical analysis and physical tests. It is possible that cassava starch might also be regarded with less disfavour for laundry purposes if this variability were eliminated.

As a sizing material cassava starch would probably be found less liable than cereal flour to induce mildew in cotton goods, on account of its much lower percentage of proteins. A sample of cassava starch prepared in Rhodesia and examined at the Imperial Institute was found to contain only 0.1 per cent. of proteins (see this BULLETIN, 1917, 15, 181; cf. also 1915, 13, 598, 603). Wheat flour generally contains from 8 to 14 per cent. of proteins.

It is possible also that cassava starch would not produce the coarseness that is sometimes found in cotton goods stiffened with farina, which is supposed to be due to the large size of the starch grains in the potato. The granules of cassava starch, which in shape somewhat resemble that of a kettle-drum, average about 0.012 mm. in cross section; they approximate in size the granules of maize starch, but are more regular in outline. Potato starch grains, which are somewhat oval in shape, vary in length from 0.05 to 0.14 mm., the breadth being never less than about half the length. Cassava is sometimes preferred to other forms of starch for sizing coloured goods, as it gives a clear "mixing" which does not destroy the brightness of the colours.

Another purpose for which cassava flour and starch can be used instead of farina is in the production of adhesives, which is an industry of some importance in this country. Cassava is also used as a source of glucose, of which it yields about 30 per cent., calculated on the weight of the fresh roots, and it should form a satisfactory material for the production of dextrin and "British gum" as well as of the dextrin "syrups" used in confectionery.

The flour could also be employed, at least in the countries where the plant is grown, as a bread-making material. Comparative information regarding the use of a number of farinaceous materials, including cassava, in conjunction with wheat flour for the production of bread, is given in *Bulletin No.* 701 (1918) *United States Department of Agriculture, "The Chemical Analysis of Wheat-Flour Substitutes and of the Breads made therefrom."* This publication gives photographs of loaves made from wheat in association with cassava and other farinaceous products. The bread made from wheat and cassava is described as having a remarkably fine texture and general appearance.

For particulars regarding the methods of manufacturing starch and other products from cassava reference may be made to the previous article in this BULLETIN (1915, 13, 600).

The Imperial Institute examined and reported on a number of samples of tapioca flour and cassava starch from British Possessions before the war, and these were valued at prices ranging from £12 to £15 per ton, according to quality, and especially colour, the best prices being paid for the whitest starch (see this BULLETIN, 1912, 10, 562).

The pre-war price in London of Dutch farina, which constituted the greater part of the imports, was from about £9 to £13 per ton according to quality. German farina of ordinary qualities was quoted round about £12, while the best German farina realised as much as £16 per ton. Latterly Japanese farina has been coming on to the

market in increasing quantities; early in the present year it was quoted in London at prices from 45s. to 60s. per cwt.

Early in 1919 cassava starch was quoted in London at prices from about 45s. to 50s. per cwt.

ALCOHOL FROM CASSAVA.

The shortage of petrol brought about by the war has had the effect of stimulating attempts in several countries to produce alcohol from a variety of saccharine and starchy vegetable materials, for use in internal-combustion engines, both for purposes of transport and for agricultural machinery.

Reference has already been made in this BULLETIN (1915, 13, 604) to the use of cassava for this purpose. As a source of alcohol, one ton of cassava roots would in practice probably yield from 30 to 35 gallons of 95 per cent. spirit; one ton of potatoes yields about 20 to 25 gallons, and one ton of cereal grain about 40 to 60 gallons of 95 per cent. spirit.

As it appears very probable, from the experience gained during the war, that alcohol will remain a competitor with petrol as a source of mechanical energy, the following notes on the use of alcohol in internal-combustion engines will be of interest.

In consequence of the fact that alcohol is less volatile than petrol it has generally been found necessary to add to the alcohol a certain proportion of more volatile material in order to enable it to be used in engines constructed to work with petrol. Thus in Natal a mixture containing 60 per cent. of alcohol and 39 per cent. of ether, with small quantities of arsenious acid and ammonia gas, has been patented for use as a motor fuel under the name "Natalite." One advantage of using ether for this purpose is that it is itself easily manufactured from alcohol.

A mixture of 20 gallons of 95 per cent. alcohol with 5 gallons of benzol to which 8 ozs. of naphthalene have been added is stated to work quite satisfactorily in petrol engines, with no alteration except to the carburettor.

Denatured alcohol can, however, quite well be used by itself in internal-combustion engines of suitable construction. The correct construction of an engine intended to burn alcohol differs in certain details from that of one adapted to run on petrol, but the differences are not great and the necessary alterations can be made without much difficulty to an engine constructed for petrol. In employing denatured alcohol alone, without the addition of a more volatile material, it is necessary to use some other means, such as warming the carburettor with a spirit lamp or otherwise, to overcome the difficulty in starting "from cold." This is not an insuperable objection with stationary engines, but would be more serious in the case of automobiles, and for the latter purpose it is likely that a mixture of alcohol with a more volatile material will be found more generally acceptable, especially as this will enable petrol engines of the existing types to be used without alteration. The proportion of the more volatile constituent could no doubt be progressively decreased as manufacturers make the necessary alterations in their engines. These questions are discussed in detail in *Bulletin No.* 6, *Commonwealth of Australia, Advisory Council of Science and Industry*, (1918), "*Power-Alcohol: Proposals for its Production and Utilisation in Australia.*"

There are other purposes for which alcohol could be employed more extensively than at present, if it were available in sufficient quantities at a cheap rate. Thus it can be used for lighting, either after being "enriched" by the addition of some liquid burning with a luminous flame, or by vaporising it, and burning the vapour in specially constructed burners with incandescent mantles. Heating and cooking appliances have also been made to burn alcohol vapour in place of coal gas.

A number of alcoholic beverages are prepared from cassava in countries where it grows, and it is used in the United Kingdom in the manufacture of spirits. The small percentages of oil and albuminoids which it contains render it very well adapted for brewing purposes; it has been employed on the Continent as a malt adjunct, and an extension of its use for this purpose has been advocated by P. Petit (*Brasserie et Malterie*, 1917, 7, 129). It was found that cassava gave good results, but its adoption appears to have been prevented by opposition based on the fact that it yields traces of prussic acid. It is claimed however, that these traces are eliminated in the process of brewing, and it would appear desirable that this fact should be authoritatively confirmed with a view to the adoption of cassava for this purpose. It is stated to be employed in the same way as rice or maize, but it is desirable to add a small quantity of sulphurous or phosphoric acid (say 3 ozs. of the latter per hundredweight) in order partly to neutralise its alkalinity, as this facilitates liquefaction and subsequent saccharification.—*Bulletin of The Imperial Institute, Vol. XVII, No. 4, 1919.*

METHODS OF TESTING CACAO BEANS.

The following notes have been contributed by Mr. T. W. Clark, Trading Manager in Grenada for Messrs. Rowntree & Co., Ltd., the well known cocoa manufacturers in England. The notes should be of interest to cacao planters as exhibiting the point of view taken by large cocoa manufacturers with regard to the quality of the raw product they purchase.

THE PREPARATION AND CURING OF THE BEANS.

The ultimate aim in the growth and preparation of cacao beans, is to give the finest possible flavour in the manufactured cocoa or chocolate. Beyond the question of securing a satisfactorily heavy crop, it is this ultimate objective (the flavour) which is the justification of the care in the choice of seedlings, the drainage and manuring of the soil, the protection of the soil, the careful picking of only those pods which are fully ripe, the lengthy period of fermentation, and the thorough drying as a preventive against mildew as advocated by the best authorities.

From the manufacturer's point of view, perhaps the most important process in the preparation and curing of the beans, is fermentation. It is by fermentation that the bitter taste is eliminated, and consequently chocolates or cocoa manufactured from fully fermented beans attain the highest standard in point of flavour.

The objection is sometimes raised that fermentation results in great loss of weight. This is erroneous. The loss of weight resulting from fermentation and drying is not materially greater than the loss from drying only provided always that the drying is complete. If the beans have not been reduced in weight by very complete drying, it follows that the cacao is not in a fit condition for shipment, and buyers may justly decline to complete a purchase until the drying is made thorough.

The process of trampling the beans is useful in rendering them more impervious to mildew. No accessories,

excepting only a little fresh water, should be used either in curing, trampling, or drying cacao beans. Such things as orange juice, oils, or lubricant from the cacao pods are quite bad. They encourage mildew, and also attract rats, which do great damage. If the beans have been subjected to full fermentation, turned several times during the process, trampled, and thoroughly dried off, no other precaution is necessary or likely to serve any useful purpose. The practice of claying the cacao is useless, and is objected to by the English manufacturers.

THE OUTSIDE APPEARANCE OF THE BEAN.

This is only important in so far as it affords indication of what the inside of the bean may be like. Such ideas as producing a 'pretty' cacao, a 'bright' cacao, etc., are quite wrong. The sole benefit of trampling is to strengthen the outer shell, thus giving a little extra protection against cracking and mildew. In manufacturing cocoa or chocolate, the outer shell of the bean is blown away by a current of air, and then collected and sold at a very low figure as a by-product. It is the inner portion of the bean only which becomes cocoa or chocolate. At the same time it should not be forgotten that a cacao buyer is, after all, quite human, and a grower who dries the beans on a sheet of galvanized iron, giving them the appearance of charcoal, should not be surprised if the buyer is prejudiced against what may really be quite good cacao.

THE SIZE OF THE BEANS.

In a general way 'mountain' cacao, *i.e.*, cacao grown at a height of 500 feet and upwards, gives a larger bean than cacao grown on the low-lying lands of Grenada. The same estate, however, is found to offer beans varying in size, and this is sometimes an indication that picking has been done before the bean was fully ripe. At the end of the crop the beans become smaller in size, and are of lower value, as such beans will give a smaller percentage of manufactured cocoa.

BAGGING THE CACAO.

Before the beans are placed in the bags, it is well worth while to make a careful inspection. Not infrequently the value of a bag of cacao is lessened by omitting to remove twigs, leaves, false beans, etc. The beans should also be cleaned in a good current of air. Some growers, in haste to effect a sale, bag up the cacao whilst still hot from the sun. This gives the beans a 'misty' appearance, and unless they are turned out and thoroughly aired, mildew will set in and speedily permeate the beans.

TESTING THE BEANS.

The tests which may be applied to cacao beans are divisible into two classes—

(a) Tests of small samples, usually about a handful.

(b) Tests of full bags.

The following are the methods by which tests may be effected.

Small Samples. (1) The beans should be cut open with a knife. If full fermentation has occurred, the inside of the bean will be of a light chocolate colour, and the veins or 'heart' of the bean will be of the same shade as the rest. If these veins are still white, or lighter than the other parts of the bean, fermentation has not been complete. If the bean is purple inside, that also is an indication of incomplete fermentation. A 'slate' colour is the sign of an unfermented bean. Sometimes the inside is found to be quite raw in appearance, like the inside of a bean when it is first taken out of the pod. This 'raw' appearance seems to be due to the pods having been picked before they were thoroughly ripe, and no amount of fermentation will bring these beans up to the best grade.

(2) The beans should be picked to pieces with the fingers, breaking first into the broader end of the bean, where the heart will be found. As mentioned in (1) if the heart is white or lighter coloured than the rest of the bean

it is not entitled to pass as first grade. When broken, the beans, if full fermentation has taken place should readily crumble into fragments. If not fully fermented the fragments will have a tendency—more or less pronounced—to cling together and the bean will not readily disintegrate. The unsatisfactory break will also be noticed in beans which have been dried and afterwards refermented; such beans will never come up to the first grade. Some samples vary considerably owing to the beans not having been turned in the sweating boxes, resulting in different degrees of fermentation in different parts of the heap.

(3) Take a handful of the beans, and, if fully fermented, it will be noticeable that the beans feel of a lighter character than unfermented beans.

(4) The beans should be rubbed between the hands to generate heat. If fully fermented, they will then give off an acid aroma. This is not one of the best tests of a small handful only, It is, however, a good test as to the presence of mildew.

(5) Taste the beans after removing the outer shell. A well fermented bean will readily disintegrate in the mouth, and the flavour will be wholesome and nutty, with something like the taste of manufactured chocolate. There should be no suggestion of the bitter taste caused by insufficient fermentation, and none of the mustiness caused by mildew.

Full Bags of Beans. (6) Let the bag fall on the floor. Fully fermented beans will give a crisp, light sound, distinctly different from the heavy 'sag' of a bag of ordinary cacao.

(7) Thump the bag. The same difference of crisp, light sound will be noticeable with the fermented cacao, as against the duller sound of 'ordinary.'

(8) Open the bag, and test the beans by hand as mentioned in (3).

(9) Run the fingers through the beans and notice the different sounds. Fermented beans will rattle like marbles, whereas 'ordinary' cacao will sound very dull.

(10) Turn the beans out on the floor. If they are fully fermented, the 'vinegar' aroma will be immediately noticed, and the acidity can also be tasted, even if one is standing a little way from the beans.

(11) Sometimes the beans feel quite 'cold.' This is often an indication that although thoroughly dried, the beans have been stored in a cold and possibly damp place. It is well to take the precaution of turning them out and allowing the air to pass through them for a time.

(12) An important point is that beans which have been cut open or picked to pieces for examination should not be returned to the bag, as these broken pieces mildew very quickly, and the mischief may easily spread.

CONCLUSION.

The necessity for a full period of fermentation cannot be too strongly emphasized. One result of the tremendous increase in the consumption of cocoa and chocolate is that the taste of the general public is now keenly critical, and manufacturers are more and more giving preference to cacao beans which, by reason of the care exercised in curing and drying, give the opportunity of attaining the highest standard in the manufactured article.—*Agricultural News, Vol. XIX, No. 477.*

PLANT DISEASES AND PEST NOTES.

DESTROYING ANTS.

We are always receiving requests for information on the best means of destroying ants. Stinging ants are very troublesome at certain times of the year, and in certain fields. The best means of destroying them is by bi-sulphide of carbon as recommended in the Journal from time to time, but this is a very dangerous substance to handle where people are careless. The following simple note taken from *Hoard's Dairyman* of 11th July, 1919, gives suggestions, that might safely be followed. The sugar will attract most ants.

If possible find the trail to the ant nest and then destroy the nest or place poison along the trails. A good poison mixture is one part of tartar emetic to 10 parts of sugar dissolved in 100 parts of water or combined with cold lard or some such grease so that it will not evaporate readily.

Poison may be spread on chips of wood or pieces of glass or china and placed in the ant trails out of the way of pet animals, The Wisconsin College of Agriculture states that where the trail to the nest is easily found, ants can be entirely destroyed by applying carbon bi-sulphide to the nest towards dusk, when the workers are at home. With a stick make three holes from three directions on the edge of the nest and towards the centre. As quickly as the stick is withdrawn each time, pour in an ounce of the poison and immediately close with damp earth, so that neither ants nor gas can come out. Wet sacks laid over the nest will help to hold the fumes. Carbon bi-sulphide should be handled carefully as it is highly inflammable.

Placing all attractive food from the reach of the ants will stop them working in the house, as a rule.

—*Journal of Jamaica Agric. Society*, Vol. xxiii., No. 9

THE GREEN PLANT BUG.

In a paper in the *West Indian Bulletin*, Vol. XVI, p. 203, it was shown by Mr. W. Nowell, then Mycologist of the Imperial Department of Agriculture for the West Indies, that the Green Plant Bug (*Nezara viridula*) was a source of considerable injury to the cotton crop by infecting bolls with fungus causing internal boll disease.

From an article in the *Quarterly Bulletin* of the State Plant Board of Florida, April 1920, it would seem that this same insect is a serious plant and fruit pest in that State. During the last ten years, it is stated, the insect has been greatly increasing in numbers, and the damage done by it is very considerable, not only in Florida, but in other states bordering the Gulf of Mexico.

It seems probable that the insect was originally a native of India, but it is now almost universally distributed throughout the tropical and sub-tropical regions of the entire world. As was noticed above, it is a cotton pest in the West Indies, and not only are its ravages reported from the southern American States, but it seems to have appeared in Australia also, and to be doing considerable damage on vegetable crops in the neighbourhood of Sydney.

Nezara viridula belongs to the group of insects commonly called true bugs, of the family Pentatomidae. The pentatomids are widely known as 'stink bugs' because they emit a very evil-smelling and ill-tasting substance, probably for protective purposes. Besides the name 'stink bug' and 'green bug,' the insect is known in the West Indies as 'bush bug,' and 'pea chink.'

The green bug feeds on many different kinds of plants. All parts of a plant are attacked, but it is particularly partial to the fruit and to tender growing shoots.

Although this insect has been found feeding on a very large number of different plants, it has been observed that it is particularly attracted to leguminous plants. In the West Indies it has been found particularly associated with the pigeon pea (*Cajanus indicus*), while in Florida it appears to be especially attracted by the cowpea (*Vigna Catjang*). It has also been observed in Florida that a species of Crotalaria is also markedly preferred by the Nezara.

The mouth parts of *Nezara viridula* are modified to form a structure adapted to piercing and sucking. This structure, known as the beak or rostrum, when not in use is folded flat, close to the ventral surface of the body, between the legs. It is an elongated, four-jointed, tube-like structure, containing four long lance-like sharp-pointed bristles with which the insect pierces the tissues of plants, and extracts the plant juice by suction. The numerous punctures caused by the insect's beak make minute, hard, brownish or blackish spots on the plant. As has been proved in the case of cotton bolls in the West Indies, these punctures may very easily become an avenue for fungus or bacterial infection leading to decay.

Studies on the habits and life-history of this insect have been carried on at Florida. From these it would appear that eggs are deposited in clusters, mostly on the under sides of leaves. The number of eggs laid by each female varied considerably. The average number of eggs contained in forty egg clusters examined was a little more than eighty-eight to a cluster. The clusters were made up of from 46 to 126 eggs.

The minimum period for incubation was four days. The minimum time for the five nymphal instars was twenty-four days, thus only twenty-eight days elapse from the time the eggs are laid until the adult stage is reached. There appear to be four generations annually in the northern part of Florida, but there are probably more in warmer regions, as it was observed that development was

more rapid during the summer than in the autumn or spring.

With regard to control of the insect, six predaceous enemies have been recorded as attacking it, the Florida predaceous bug (*Euthyrhyncus floridanus*) being the most important. In laboratory investigation three parasites of the adult insect, and two parasites of the egg have been reared. From observation it would appear that by the spread of these parasites this insect may possibly be controlled effectively.

Another method of control suggested is the planting of some leguminous plant—*Crotolaria usamaroeusis* is mentioned—to serve the purpose of a trap from which the insects might be collected and destroyed. This plant also seems to be, owing to its flowers, very alluring to the parasites of the bug. It is recommended that, if a trap plant is used, the best method for collecting and controlling the insect is by hand picking. The habit of the insect when suddenly disturbed, or when the plant on which it is feeding is jarred, of dropping to the ground, renders hand collecting feasible. In fact it has been demonstrated that the bugs can be collected economically, when they are destroying or injuring fruit, by the use of quite large nets which are held beneath the plant or tree, and the bugs shaken into them.

POULTRY.

COMMON HOUSEHOLD REMEDIES FOR POULTRY.

The drug store necessary for poultry ailments need be neither an extensive nor an expensive one; in fact it can practically be confined to those drugs and substances to be found in any household or on any farm; the most common of these are the following:—

Bicarbonate of Soda is useful in the treatment of sour crop, sometimes known as enlarged crop, as an aid to digestion, and in poisoning by some vegetable acids, e.g., tannic acid poisoning with acorns or oak leaves.

The ordinary blue bag can be brought into use as a remedy for a very common disease in this country, viz., warts or chicken pox, and will prove very efficacious. The procedure is to scarify the wart and rub some of the contents of the blue bag (sulphate of copper) upon it; three or four daily applications will suffice to effect a cure.

Cart Grease.—This, mixed with powdered lime, and applied in the same manner as the above to warts, is also an excellent remedy.

Epsom Salts.—One of the poultry-keeper's most useful and valuable drugs, it is decidedly the best laxative we have for poultry. Castor oil, by the way, which is frequently given, is a dangerous drug to use for poultry, for although in a few cases it has no detrimental effect, on the majority of fowls it is almost a poison. Should a fowl look out of sorts or disinclined for its food, give it at once a tea-spoonful of epsom salts dissolved in a little warm water; this often prevents a serious illness, and causes the bird to recover its normal condition. Every bird should be given a dose regularly once every four weeks in the winter and once every two weeks in the summer, in the proportion of 1 oz. for every ten birds. The best method of administering it is by mixing it in the mash feed. Epsom salts is also useful as a remedy for soft-shelled eggs and those with small clots of blood in

them; a quarter of a teaspoonful also dissolved in two tablespoonfuls of water with a small quantity of permanganate of potash (just enough to give a slightly pink colour to the solution) is often of great value in the early stages of enteritis.

Jeyes' Fluid.—A solution of this (nine tablespoonfuls to two gallons of hot water) should be used for spraying the houses once every six or eight weeks. It is also useful as a dip for those birds infested with lice, in the proportion of two tablespoonfuls to a paraffin tin of warm water. Other disinfectants, such as Cooper's or Little's dips, Kerol, milk-oil fluid, etc., well diluted, are also valuable for the same purpose.

Lard is the cheapest and best medium for the preparation of ointments, for instance, for scaly leg. Heat 1 lb. of lard till quite liquid; to this add one tablespoonful of Jeyes' fluid, or similar disinfectant, and stir occasionally till quite cold and set. After scrubbing the legs with water and soap, rub the ointment well in once a day for three or four days. The same complaint may also be cured by applying a mixture of ½ lb. of lard and one tablespoonful of flowers of sulphur. The same ointment is efficacious in the case of sand fleas.

Lime.—In addition to its use mixed with cart grease, as mentioned above, this substance is very valuable as a disinfectant for tainted runs. The quick-lime should be used, spread thickly over the ground, and then dug well in, and the run allowed to remain empty for several weeks. Powdered slaked lime is also useful as a dusting powder, or mixed with the earth on the spots on which the birds have their natural dust-baths. It is an excellent insecticide, and can be used with advantage either in the nest boxes or in nests for setting hens. Very little suffices to keep them free from insects, but care should always be taken that it is well slacked and well powdered.

Oils.—Linseed oil is an excellent remedy in cases of acid poisoning. Sweet oil and salad oil are also useful in these cases; both too, have a light laxative effect. In crop binding,

two teaspoonfuls of either poured into the crop, and the latter kneaded between the fingers will often effect a cure; injected into the vent they will usually help an egg-bound hen to pass her egg without trouble. A few drops of either, too, administered three times a day to a bird suffering from catarrah will cure it.

Paraffin Oil is useful for the purpose of spraying and rubbing over the perches. I do not recommend it internally, as it has a very irritant effect.

Permanganate of Potash.—A weak solution of this is useful for washing any wounds or sores also for purifying doubtful drinking water and washing soiled eggs for incubation.

Onions.—These are also excellent as a cure for catarrh also as a tonic. Further, a small quantity fed now and then to the birds in cold wet weather is a good preventive of colds. For young chickens they are invaluable to tone up the system and quicken growth.

A Rusty Iron Nail placed in the drinking water acts as an excellent tonic; it is an old-fashioned method of supplying iron to the system, but a very good one.

Common Salt.—A pinch of this should always be added to the soft food. It is a good corrective, and aids digestion, but an overdose is fatal.

Flowers of Sulphur.—As mentioned above, in conjunction with lard this makes a good ointment for scaly leg also for the destructon of lice. In hot weather, mixed with the soft food (one-quarter of a teaspoonful to each bird once a week), it acts as a good blood purifier, but it should never be given in cold weather. It is excellent also during the moulting period to promote the growth of feathers and for chickens which are not feathering well. In the form of an ointment, too, it is a good remedy for warts, simple skin diseases, and feather plucking.

Tea (cold).—Bathing the vent with this after the application of hot water is very beneficial in cases of protrusion of the vent.

Glycerine.—Six drops of this three times a day will usually cure catarrah and mild cases of bronchitis.

Turpentine.—Twelve drops in one teaspoonful of sweet oil an hour before the morning feed, and last thing at night. for four or five days, will usually cure the most obstinate case of worms in a week; for chicks of from three to six months old give eight or nine drops.

Vinegar.—This applied hot to warts is also an excellent remedy in conjunction with a good dose of flowers of sulphur; the wart should be bathed three times a day.

Washing Soda.—In cases of rheumatism, with loss of power in the legs, dissolve a small handful of this in hot water and hold the bird's legs up to the hock joints in it for a few minutes, then rub some embrocation into the joints, and the bird will quickly recover.—FARMERS' JOURNAL, Vol. 2, No. 13.

THE COAGULATED LATEX OF THE SOUTH AMERICAN COW-TREE.

A sample of coagulated latex derived from a tree believed to be *Galactodendron utile* H. B. and K. (*Brosimum Galactodendron*, Don.) was received from the Agricultural Adviser to the Government of Colombia early in 1918. It was stated that the material was being exported to the United States for the manufacture of chewing-gum. *B. Galactodendron* is the well-known cow-tree of the Cordilleras. It is a large tree, sometimes reaching a height of 100 ft., and belongs to the Natural Order Moraceæ, being closely related to the Castilloa rubber tree and *Ficus elasticia*. When incisions are made in the trunk or branches there is a copious flow of white, somewhat viscid latex, which closely resembles cow's milk in appearance and flavour. This fluid is said to possess considerable nutritive value and is largely used by the natives as a food. On standing it becomes yellow and gradually thickens to the consistency of cheese.

The sample sent to the Imperial Institute consisted of a block of gutta-like material of a pale buff tint. The material was hard and somewhat friable, but could easily be cut with a knife; under pressure in the hand it became somewhat softer and malleable.

The material was examined at the Imperial Institute with the following results :

	Expressed on material as received Per cent	Expressed on the dry material. Per cent
Moisture	8.4	—
Resin	83.2	90.8
Impurities	2.9	3.1
Including:		
Protein	0.23	—
Ash	0.14	—
"Gutta" (by difference)	5.5	6.1

The resin (*i.e.* the matter soluble in acetone) chiefly consisted of an opaque material of light brown colour together with a darker brown resinous-looking body. The

residual "gutta" left after the removal of the resin was very soft and plastic at ordinary temperatures.

The above results show that this Galactodendron latex contains a small amount of "gutta" and a large proportion of resin. When slowly warmed it becomes sufficiently soft and plastic to be moulded without being sticky, and on cooling it becomes firm but distinctly brittle, as might be expected from the large amount of resin present.

The material is too brittle and resinous to be of use as a substitute for balata or gutta-percha, but it exhibits considerable resemblance to pontianac, which is largely used in rubber compounding for adding plasticity to the mixings.

A firm of manufacturers to whom a sample of the Galactodendron latex was submitted considered that the material could be used in the rubber industry as a substitute for pontianac. In their opinion the material would even be preferable to pontianac, being less brittle and more rubber-like in properties, and they valued it at 1s. 2d. per lb. in the United Kingdom in comparison with washed dried pontianac at 1s. per lb.

This Galactodendron latex differs in composition from "chicle gum," derived from *Achras sapota*, which is largely used for the manufacture of chewing-gum, as it contains more resin and less gutta. It is, however, similar in physical characters and becomes plastic when chewed; further, it is of pale colour and free from any appreciable amount of bark or mineral matter, so that it should be readily saleable for the manufacture of chewing-gum. A firm of brokers classed the sample as "gum chicle," but stated that, owing to the difficulty of obtaining adequate supplies of sugar, there was only a small demand in the United Kingdom at the time for such material for confectionery purposes (November 1918). They considered that its value would be about 1s. 9d to 2s. per lb., but added that large consignments could not be recommended.

—Bulletin of the Imperial Institute.—Vol. XVII.

THE TREATMENT OF RUBBER PLANT NURSERIES.

It is generally acknowledged by keen horticulturists who have visited the tropics that too little importance is attached to the nursery side of rubber, and even tea and coffee plantations. The seeds used for the nurseries are collected by ordinary coolies, and after the casual test of "sinking or swimming" in water no further selection appears to be adopted prior to germination. After germination watering and thinning out is, of course, attended to, and prior to planting, selection usually takes place. The nursery beds should be, but are not, always changed, the same site sometimes being used for a considerable time. In the April issue of the "Annals of Applied Botany," Drs. Kidd and West have contributed a further important article on the influence of the condition of the seed upon the course of subsequent growth, and also upon the yield. Unfortunately most of their experiments have been made with plants which only grow in emperate zones. The results obtained and the methods of investigation are, however, of such outstanding importance that we venture to give a somewhat lengthy account of a part of the work published. The authors are of opinion that the vigour of the seedling is not only due to hereditary causes, but also to environmental factors which have operated during or previously to germination. They have recorded special seed-treatments which have been found to stimulate germination and also the growth of the actual plants. The seed-treatments referred to are classified under the following headings :—

1. Removal or partial removal of the Cotyledons Endosperm ;
2. Soaking treatments ;
3. Seed impregnation treatments ;
4. Enzyme treatments.

The first class of seed-treatment is, perhaps, of least direct interest to tropical planters. The experiments regarding the soaking of seeds in water is, however, a line

of investigation which can well be borne in mind. The effect of soaking seeds in water depends upon the external conditions during the soaking treatment and upon the duration of that treatment. The following conclusions are given by the authors in respect to the effect of soaking and germination :—

" (a) Seeds soaked in the minimum amount of water and afterwards *slowly dried* at ordinary temperatures imbibe water and develop more quickly, when again allowed to take up water and germinate, than untreated seeds.

(b) Seeds which are *rapidly dried* after the initial soaking germinate more slowly than untreated seeds.

(c) Seeds swollen in water and sown in the still moist condition germinate more quickly than untreated seeds.

(II.) *Effect on subsequent growth and final yield.*

(a) In general, seeds soaked in water previous to germination give rise to slightly fewer plants than untreated seeds. If the seeds are re-dried too rapidly the number of plants produced may be considerably diminished.

(b) Soaking seeds in water previous to germination tends to accentuate individual differences in the growth of the plants produced from them.

(c) Plants from seeds swollen in water previous to sowing develop at first more quickly than those from untreated seeds, but this initial difference in growth tends to disappear later on.

(d) At a later stage the experimental plants take the lead, and flower before the control plants.

(e) The experimental plants have a longer growth-period and flowering-period than the control plants, arrive at maturity at a later date and give larger final yields, and his probably accounts for the fact that plants from seeds hich are soaked in water previous to sowing are more Wroductive than plants from untreated seeds.

(f) Soaking the seed in a relatively large volume of water, for instance, ten volumes of water to one volume of seed, reduces the beneficial effect, and may even be harmful.

(g) The soaking treatment is especially useful when the seeds are sown in light dry soil, provided that the seed is well covered with the soil."

With regard to the effect on yield, the authors conclude that as between untreated seeds and seeds soaked but sown in a moist condition there was an increase in yield when the latter course was adopted. Considerable importance is attached to the conditions under which the soaking treatment is carried out as too long a period of soaking produces injury and even death.

Soaking Seeds in Solutions.—It is recognized that the young germinating plant lives mainly on the reserve material contained in the seed-leaves ; this is especially so with rubber, coffee, tea and cocoa. One might have expected the seeds which were soaked in solutions of nutrient salts would show far better results than those soaked in water alone. The results show, however, that the germination, subsequent growth and yield obtained from seeds which were soaked in nutrient salts were not appreciably better than those obtained with pure water ; this result was obtained even when the solution of nutrient salts consisted of (1) a 20 per cent. solution of potassium nitrate and (2) a solution consisting of 5 per cent. phosphoric acid, 10 per cent. nitrogen, and 10 per cent. potassium. The effect of the application of a manure containing these ingredients at a later stage when the seedlings have been established is not given.

Effect of Enzymes.—The peculiar subtances known as Enzymes are largely responsible for converting food reserves into such a form that they can be absorbed and used by the growing plant. Experiments have been made with the object of supplying the seed artificially with products usually resulting from the breaking down of its own food reserves, also with supplying the seed with enzymes. So far, however, the results of such treatment have not been very encouraging.—*India-Rubber Journal, Vol. LVIII., No. 1.*

THE PRINCIPAL VARIETIES OF SUGAR CANE UNDER CULTIVATION IN B. GUIANA DURING 1918-1920.

By the Director of Science and Agriculture.

The following table shows the area occupied by the principal varieties of canes under cultivation for the crops of 1920:—

Principal Varieties of Canes—1918, 1919 and 1920.

AREAS IN BRITISH GUIANA.

Variety.	1918.	1919.	1920.	Increase or decrease on 1919.	
	Acres.	Acres.	Acres.	Increase.	Decrease.
D. 625	36,000	34,142	36,100	1,958	/
Bourbon	4,950	3,465	2,926		539
D. 625 mixed with Bourbon and other seedlings.	7,800	7,806	8,561	755	
D. 145	5,920	4,667	5,183	516	
B. 208	4,550	3,601	3,118		483
D. 109	320	388	470	82	
Diamond 185	1,120	930	1,174	244	
Green Transparent	1,320	1,131	976		155
D. 118	2,710	2,676	3,608	932	
D. 419	1,370	1,675	1,887	212	
Java seedlings	630	507	903	396	
B. 147	110	186	101		85
D. 167	140	138	123		15
D. 4399	46	13	24	11	
B. 6450	43	58	47		11
Diamond 37	89	106	130	24	
B. 376	350	394	344		50
D. 4397	17	29	9		
Ba. 6032	56	112	155	43	
B. H. 10 (12)	—	34	69	35	
D. 216	116	83	90	7	
D. 179	49	63	60		3
R. P. 1.	72	72	22		50
R. P. 8	429	485	563	78	
R. P. 21	79	97	119	22	
R. P. 23	77	77	40		37
R. P. 73	121	150	69		81
D. 418	—	47	—		47
D. 199	47	42	3		39
Small areas of other varieties and areas under varieties unenumerated.	9,692*	10,640**	614		10,026
	78,223	73,814	67,488	5,315	11,647

Note.— * ** Principally turn overs for subsequent crops.

The average yields in tons of commercial sugar per acre of the principal varieties under cultivation for the crops of 1919, as deduced from the returns supplied by the Managers of the sugar plantations were as follows :—

CROPS OF 1919.

	D. 625		D. 145		B. 208	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean all plantations	1.47	25,993	1.51	4,705	1.29	3,165
Maximum reported	2.81	59	2.48	70	1.82	7
Minimum reported	.76	744	.60	9	1.28	8

	Bourbon.		<> 185		Green Trans.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean all plantations	1.40	2,683	1.36	925	1.57	425
Maximum reported	2.11	18	2.00	647	2.15	93
Minimum reported	1.00	35	.88	25	1.30	40

	D. 118		D. 167		D. 419	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean all plantations	1.54	2,756	1.61	106	1.42	1,544
Maximum reported	2.35	7	2.42	4	2.20	3
Minimum reported	.65	19	1.00	6	1.02	62

	Java varieties.		Ba. 6032		B. 6450	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean all plantations	1.72	706	1.67	62	1.93	33
Maximum reported	2.50	5	2.32	9	2.95	12
Minimum reported	1.33	262	1.15	7	10.8	15

	B. H. 10 (12.)		B. 147.		D. 109.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean, all plantations	2.44	12	1.34	96	1.38	431
Maximum reported...	2.55	3	1.48	25	1.95	4
Minimum reported ...	2.33	9	1.20	71	0.90	98

	D. 216.		D. 4399.		Mixed.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Mean, all plantations	1.88	79	0.82	19	1·40	7,586
Maximum reported...	3.50	5	1.06	15	2.02	71
Minimum reported ...	1.17	48	0.57	4	0.62	19

The following tables indicate similar figures as the preceding but they are compiled from the results supplied by the larger plantations only.

CROPS OF 1919.

	D. 625.		D. 145.		B. 208.	
	Yields.	Acreage.	Yields.	Acreage.	Yields	Acreage.
Means, larger plantations only ...	1.58	18,257	1.60	4,625	1.39	3,138
Maximum reported...	2.81	59	2.48	70	1.82	7
Minimum reported ...	1.02	1,441	0.67	33	1.00	38

	Bourbon.		Green Trans.		D. 118.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Means, larger plantations only ...	1.62	1,458	1.59	400	1 51	2,367
Maximum reported...	2.11	18	2.15	93	2.35	7
Minimum reported ...	1.10	35	1.30	40	1.17	198

	D. 419.		◇ 185.		Java.	
	Yields.	Acreage.	Yields.	Acreage.	Yields.	Acreage.
Means, larger plantations only ...	1.42	1,544	1.35	765	1.72	706
Maximum reported...	2.20	3	2.00	647	2.50	5
Minimum reported ...	1.02	62	0.88	25	1.33	262

The following Table indicates the relative distribution of the various kinds of Cane during the crops of 1916, 1917, 1918, 1919 and 1920.

VARIETY.	For Crops of				
	1916	1917	1918	1919	1920
D. 625	49.1	48.2	47.9	46.2	50.9
Bourbon	12.0	9.4	6.4	4.7	4.1
D. 145	8.0	7.9	7.7	6.3	7.3
B. 208	7.9	6.4	5.9	4.8	4.4
D. 625 mixed with Bourbon and other Seedlings	7.0	5·4	10.2	10.6	12.1
D. 109	2.3	1.1	.4	.5	.7
Diamond 185	2.1	1.8	1.5	1.1	1.7
Green Transparent	1.8	1.9	1.7	1.5	1.4
D. 118	1.2	2.1	3.5	3.6	5.1
D. 419	.5	1.6	1.8	2.3	2.7
Java Seedlings	—	—	.8	.7	1.4
Providence 8	—	—	.5	.7	.9
B. 376	—	—	.4	.5	.5
Other varieties Unenumerated ...	8.1	14.2	11.3	16.5	6.8
	100.0	100.0	100.0	100.0	100.0

From the returns supplied by the sugar plantations, the distributions of the various sugar canes in cultivation for the Crops of 1916, 1917, 1918, 1919 and 1920 according to their origin are as follows :—

	1916	1917	1918	1919	1920
Bourbon and other Old Varieties ..	17.2	16.7	13.0	13.1	8.9
Java	.3	.4	.8	.3	1.4
Barbados	9.2	7.1	6.7	5.9	5.7
British Guiana { Plus. Diamond and Providence ...	2.6	2.7	2.6	2.6	3.2
British Guiana { Botanic Gardens ...	70.7	73.1	76.9	77.8	80.8
	100.0	100.0	100.0	100.0	100.0

The results of large scale field-trials with other varieties on the sugar plantations are shown in the following table:—

VARIETY.	ACREAGE.	YIELD.
B. 3922	17	2.89
D. 433	7	2.53
R.P. 20	17	2.34
P.L. 374	7	2.33
D. 651	1	2.30
D. 246	2	2.30
P.L. 264	8	2.25
D. 721	24	2.23
D. 167	12	2.18
◇ 37	92	2.12
R.P. 21	92	2.09
R.P. 1	61	1.97
R.P. 8	478	1.83
B. 376	310	1.81
R.H. 1	6	1.75

ATTENDANCES AT THE DISTRICT GARDENS

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendance.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,577
1915 ...	1,123	1,006	769	59	503	339	401	4,200
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,886
1918	4,834	3,081	1,653	2,671	2.162	2,790	2,067	19,258
1919	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,461
1920								
1st Quarter	1,235	749	445	397	595	840	483	4,834
2nd Quarter	1,792	560	489	723	790	976	709	6,039
3rd Quarter	1,455	364	229	597	429	600	366	4,040

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first nine months 1920. The corresponding figures for the two previous and the average for the four years previous to that are added for convenience of comparison.

Product.	*Average 1914-17.*	*1918.*	*1919.*	*1920.*
Sugar, tons ...	60,348	64,427	43,583	48,442
Rum, gallons	2,703,920	2,016,173	3,438,593	1,188,175
Molasses, gallons	42,584	28,186	171,247	100
Cattle-food, (Molascuit) tons	1,208	1,876	1,112	953
Cacao, cwts. ...	297	85	85	207
Citrate of Lime, cwts.	170	27	306	206
Lime Juice, gals.	4,910	11,390	6,663	2,641
Essential Oil of Limes, gals.	115	162	291	236
Coconuts, thousands	1,428	824	3,040	2,139
Copra, cwts. ...	1,365	2,010	1,602	,296
Coffee, cwts. ...	2,504	2,924	7,993	3,554
Kola-nuts, cwts. ...	6	24	None	9
Rice, tons ...	8,710	7,963	3,158	8,084
Ricemeal, tons ...	209	66	None	None
Cattle, head ...	659	306	1	4
Hides, No. ...	2,908	2,263	5,369	5,166
Pigs, No. ...	807	None	None	None
Sheep, head ...	45	10	None	66
Balata, cwts. ...	7,707	3,628	4,999	7,740
Charcoal, bags ...	43,767	29,054	33,020	35,749
Firewood, Wallaba, etc., tons ...	8,296	5,233	5,939	3,977
Gums, lbs. ...	470	60	2,001	3,361
Lumber, cub. ft. ...	195,144	92,530	173,237	207,476
Railway sleepers, No.	10,380	6,510	2,008	10,707
Rubber, cwts. ...	57	142	79	134
Shingles, thousands	1,755	2,009	1,932	1,722
Timber, cub. ft. ...	105,115	8,026	98,303	57,088
Coconut Oil, gals....	12,770	23,112	6 371	12,176

Meteorological Data—July to September 1920.

Botanic Gardens Months, 1920	Rainfall. Inches.	Number of days of rain. Under ·10 Inches	·10 to ·50 Inches	·50 to 1.00 Inches	1.00 to 2.00 Inches	Above 2.00 Inches	Total	EVAPORATION Inches	Air Temperature and Humidity. Maximum	Minimum	Mean	Humidity Mean
July ...	6.84	5	11		...	...	21	4.46	84.7	74.8	79.7	83.7
August ...	5.53	4	8		1	...	16	5.14	86.2	75.4	80.8	79.6
September...	2.85	3	5		...	...	10	5.57	86.7	75.4	81.0	77.2
Totals	15.22	12	24	10	1	...	47	15.17				
Mean	...	...	..	...	...	...	...	...	85.9	75.2	80 5	80·1
Onderneeming												
July ...	8.39	...	7	6	2	...	15	...	87.3	73.2	80.2	
August ...	5.88	1	8	5	...	...	14	...	87.1	73.3	80.2	
September..	1.31	...	6	.1	...	...	6	...	89.2	73.5	81.3	
Totals	15.58	1	21	11	2	...	35	...				
Mean	...	...	..	...	...	...	...	...	87.8	73.3	80.5	...
Berbice Gardens.												
July ..	10.18	5	6	2	2	2	17	...	91.7	75.9	83.3	75.1
August ...	6.08	1	7	4	1	...	13	...	91.6	75.9	83.7	80.2
September...	1.54	2	3	1	...	...	6	...	92.2	76.1	84.1	76.5
Totals	17.80	8	16	7	3	2	36	...				
Mean	...	...	...	...	...	...	...	...	91.8	75.9	83.7	77.2
Morawhanna												
July ...	26.82	3	6	7	8	3	27	...	...	...	...	...
August ...	10.00	1	11	5	2	...	19	...	...	...	...	...
September..	*	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...

*Not yet available.